

1 HANDS-FREE KIT FOR MOBILE PHONE

2

3 The present invention relates to a hands-free kit for use with
4 a mobile phone.

5

6 BACKGROUND OF THE INVENTION

7

8 Hands-free kits, each including an earphone and a microphone,
9 are becoming popular for use with portable mobile phones, as
10 they free the hands of a user who can then attend to other
11 things as desired or with care, such as driving a vehicle.
12 Experiments or statistics suggest that the electromagnetic
13 radiation emitted by a mobile phone may be harmful to the
14 brain. Although a hands-free kit is useful to keep the mobile
15 phone physically away from the head, electrically conductive
16 parts of the kit, including in particular the earphone that is
17 in use located in the ear, also transmit and emit
18 electromagnetic radiation.

19

20 The invention seeks to mitigate or to at least alleviate such a
21 problem by providing a hands-free kit for a mobile phone.

22

23 SUMMARY OF THE INVENTION

24

25 According to a first aspect of the invention, there is provided
26 a hands-free kit for a mobile phone having a hands-free
27 connection port, comprising a speaker, a microphone, a
28 connector for connection with a said port, an electrical cable

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1 connecting the speaker and the microphone to the connector, and
2 a tube having a first end connectable with the speaker and a
3 second end comprising an earplug. The tube is adapted to act as
4 an acoustic passage to transmit sound reproduced by the speaker
5 to the earplug.

6

7 Preferably, the tube is flexible, and may be made of non-
8 metallic material, such as rubber or plastic material.

9

10 It is preferred that the speaker has a body, and the first end
11 of the tube receives to enclose and thus connect with the
12 speaker body.

13

14 It is further preferred that the tube is enlarged at its first
15 end to connect with the speaker body, and includes a section
16 immediately adjacent the enlarged end that is tapered to
17 concentrate sound emitted by the speaker into the tube.

18

19 According to a second aspect of the invention, there is
20 provided an acoustic passage for use with a mobile phone hands-
21 free earphone comprising a speaker and a microphone, which
22 passage comprises a tube having a first end comprising means
23 for connecting with a said speaker and a second end comprising
24 an earplug. The tube is adapted to transmit sound reproduced by
25 the speaker to the earplug.

26

27 Preferably, the tube is flexible, and may be made of non-
28 metallic material, such as rubber or plastic material.

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2 It is preferred that the first end of the tube is adapted to
3 receive and thus connect with a said speaker.

4

5 It is further preferred that the first end of the tube is
6 enlarged for connecting with a said speaker, and the tube
7 includes a section immediately adjacent the enlarged end that
8 is tapered to concentrate sound emitted by a said speaker into
9 the tube.

10

11 In a preferred embodiment, said means comprises an enclosure
12 which provides a cavity adapted to house and locate wholly
13 therein a said speaker and includes an opening to which the
14 first end of the tube is connected for communicating with the
15 cavity.

16

17 Preferably, the cavity has an entire inner surface and is
18 provided with a metal shield that covers a substantial part of
19 the entire inner surface to surround a said speaker.

20

21 More preferably, the shield is formed by two substantially
22 identical shells closing with each other.

23

24 It is preferred that the shield has a shape matching with that
25 of the inner surface of the cavity and is in ultimate surface
26 contact therewith.

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1 Preferably, the enclosure provides a first cavity that is the
2 first mentioned cavity and also a second cavity that provides a
3 sound passage which has a first end connected to the first
4 cavity for communicating therewith and a second end that acts
5 as the opening to which the first end of the tube is connected.

6

7 More preferably, the sound passage extends in a substantially
8 spiral manner having an outer end as the said first end and an
9 inner end as the said second end.

10

11 Further more preferably, the sound passage has at least half a
12 turn and up to two turns.

13

14 Preferably, the enclosure provides another cavity adapted to
15 house and locate wholly therein a said microphone.

16

17 More preferably, said another cavity has an entire inner
18 surface and is provided with a metal shield that covers
19 substantially the entire inner surface to surround a said
20 microphone.

21

22 Further, the shield is preferably formed by two substantially
23 identical shells closing with each other.

24

25 It is preferred that the shield has a shape matching with that
26 of the inner surface of the cavity and is in ultimate surface
27 contact therewith.

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1 In a specific construction, the enclosure is to be formed by
2 two connected parts having respective walls abutting each
3 other, which walls are shaped and combine to form at their
4 interface the cavity or cavities.

5

6 More specifically, the or each cavity is formed by two
7 substantially identical parts, one from the wall of each part
8 of the enclosure.

9

10 Conveniently, the enclosure has an open outer side and a hollow
11 interior accessible through the open side for storing at least
12 part of the tube and the earplug.

13

14 Conveniently, the enclosure is provided with a fastener for
15 fastening the overall acoustic passage onto the body of a user.

16

17 In a specific construction, the earplug comprises a tubular
18 plug for insertion into the hole of a user's ear and an
19 integral outer member extending around the plug for holding
20 onto the inner surface of a said user's ear by friction.

21

22 The acoustic passage may be combined with a mobile phone
23 hands-free earphone comprising a speaker and a microphone, in
24 which the speaker is housed within the or the first cavity.

25

26 The acoustic passage may be combined with a mobile phone
27 hands-free earphone comprising a speaker and a microphone, in

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1 which the speaker is housed within the or the first cavity
2 and the microphone is housed within said another cavity.

3

4 BRIEF DESCRIPTION OF DRAWINGS

5

6 The invention will now be more particularly described, by way
7 of example only, with reference to the accompanying drawings,
8 in which:

9

10 Figure 1 is a cross-sectional view of a first embodiment of a
11 hands-free kit in accordance with the invention, showing its
12 use with a mobile phone;

13

14 Figure 2 is a side view of a conventional hands-free earphone;

15

16 Figure 3 is a cross-sectional side view of a second embodiment
17 of a hands-free kit in accordance with the invention, said kit
18 incorporating the hands-free earphone of Figure 2;

19

20 Figure 4 is a top plan view of the hands-free kit of Figure 3;

21

22 Figure 5 is a bottom plan view of the hands-free kit of Figure
23 3;

24

25 Figure 6 is a top plan view of the hands-free kit of Figure 3,
26 showing the kit in a packed condition;

27

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1 Figure 7 is a cross-sectional end view of the packed hands-free
2 kit of Figure 6;

3

4 Figure 8 is a bottom plan view of a slightly different
5 embodiment of the hands-free kit of Figure 3; and

6

7 Figure 9 is a side view of a modified earplug for the hands-
8 free kit of Figure 3 or Figure 8.

9

10 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

11

12 Referring initially to Figure 1 of the drawings, there is shown
13 a first hands-free kit 100 embodying the invention for use with
14 a portable mobile phone 10, which kit 100 comprises a macro
15 speaker 110, a microphone 120 and a flexible rubber tube 130.
16 The speaker 110 is connected to the microphone 120 by means of
17 a multi-cored cable 140 that extends beyond the microphone 120.
18 The cable 140 terminates at an end fitted with a signal plug
19 150 designed for insertion into a hands-free connection port
20 provided at the bottom end of the mobile phone 10.

21

22 The speaker 110 has a body 112 and includes a sound reproducing
23 mechanism, such as a diaphragm driven by a moving coil and
24 electromagnet, for reproducing sound from an electrical signal
25 supplied by the mobile phone 10 via the cable 140. The
26 microphone 120 has an oval-shaped body 122 which is connected
27 at an intermediate position along the cable 140 and includes a
28 press knob 124 for accepting or terminating a telephone call.

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2 The tube 130 has a front end provided with an earplug 132 and a
3 rear end that is suitably enlarged to form a receptacle 134,
4 for example, for receiving to enclose and thus connect with the
5 speaker 110. The main body of the tube 130 acts as an acoustic
6 passage for transmitting or delivering sound from the speaker
7 110 to the earplug 132, and is made generally as thin as
8 possible for flexibility and lightweight.

9

10 The earplug 132 has a front opening and is preferably
11 integrally formed at the front end of the tube 130, or
12 otherwise formed as a separate part connected thereto. The
13 earplug 132 is shaped and sized to anchor within the user's
14 ear.

15

16 The receptacle 134 has a shape corresponding to that of the
17 body 112 of the speaker 110 and is preferably slightly
18 stretchable for enclosing the speaker body 112 to connect tight
19 therewith. The section of the tube 130 immediately adjacent the
20 receptacle 134 is preferably made to taper in a conical manner,
21 gradually reducing in diameter from the receptacle 134, for
22 concentrating and directing the sound emitted by the speaker
23 110 into the tube 130.

24

25 The rubber tube 130 serves to separate the speaker 110 apart
26 from the user's ear as far as possible for a distance that is
27 in effect the length of the tube 130, thereby isolating or at
28 least substantially minimising the effect of the

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1 electromagnetic radiation of the mobile phone 10 as transmitted
2 or emitted by the speaker 110. The tube 130 acts as a voice
3 collector bridging from the speaker 110 to the user's ear, said
4 connector containing no metallic or electrically conductive
5 material to transmit electromagnetic radiation.

6

7 In general, the tube 130 is made of non-metallic material.

8 Specifically, the tube 130 is preferably made of rubber,
9 silicone rubber or other suitable plastic material. It is known
10 that certain material can suppress or absorb electromagnetic
11 radiation, and such material is also suitable for producing the
12 tube 130, as either the base material or an additive.

13

14 In the described hands-free kit 100, the tube 130 is about 20cm
15 long, and the microphone 120 is connected on the cable 140. In
16 a different construction, it is envisaged that the microphone
17 120 may be mounted on the tube 130 instead, at around the rear
18 end of the tube 130, such that the microphone 120 is positioned
19 closer to the user's mouth.

20

21 Apart from the tube 130, the other parts of the hands-free kit
22 100 may be standard components of a conventional hands-free
23 earphone, with the speaker 110 being in the form of a typical
24 earphone. It is therefore intended that the tube 130 may be
25 supplied alone as an accessory for use with an existing hands-
26 free earphone, in which case the rear end of the tube 130
27 should be fabricated for (releasable) connection to the
28 earphone.

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1
2 Reference is now made to Figures 2 to 7 of the drawings, which
3 show a second hands-free kit 200 embodying the invention for
4 use with a portable mobile phone. The kit 200 incorporates a
5 conventional hands-free earphone 12 that comprises a macro
6 speaker 13 and a microphone 14 and includes a signal plug 15 to
7 which both the speaker 13 and the microphone 14 are connected
8 by means of a multi-cored cable 16. The plug 15 is designed for
9 insertion into a hands-free connection port of a mobile phone.

10
11 The hands-free kit 200 includes an enclosure in the form of a
12 rectangular (or round) plastic box 210 having opposite first
13 and second ends 212 and 214, which is formed by top and bottom
14 parts 220 and 230 that have matching rectangular (or round)
15 shapes and are stacked and secured together by ultrasonic
16 welding. The top and bottom box parts 220 and 230 have
17 respective lower and upper walls 222 and 232 abutting each
18 other, which are both moulded to form in their interfacing
19 surfaces a series of three enclosed cavities 240, 250 and 260
20 along the longitudinal extent of the box 210. An external
21 fastener in the form of a spring-loaded clip 216 is provided at
22 the second end 214 of the box 210.

23
24 Each cavity 240/250/260 is created by a corresponding pair of
25 aligned recesses closing with each other, which have
26 substantially identical shapes as mirror images compared with
27 each other and are formed in the confronting walls 222 and 232
28 of the two box parts 220 and 230 respectively. The first and

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1 second cavities 240 and 250 are in communication with each
2 other.

3

4 The first cavity 240 is generally pear-shaped having a
5 conically tapered open front end 242 and houses wholly therein
6 the speaker 13 of the hands-free earphone 12. A metal (copper,
7 aluminium or iron) shield 244 of a matching shape is located
8 within the cavity 240 to cover, in ultimate surface contact
9 with, a substantial part of the entire inner surface of the
10 cavity 240. The shield 244 surrounds the speaker 13 and is
11 intended to confine the electromagnetic radiation of the
12 speaker 13 within the cavity 240 and thus avoid or minimise its
13 leakage out of the cavity 240. The shield 244 is formed by a
14 pair of identical upper and lower shells 246 closing with each
15 other, together having a conically tapered open front end 248
16 aligned with the open end 242 of the cavity 240.

17

18 The speaker 13 is preferably surrounded tight by a ring 249 of
19 a soft material such as rubber and is then clamped between the
20 two shells 246 of the shield 244. The ring 249 serves to ensure
21 that the speaker 13 is fixed and is better acoustically
22 shielded. The speaker 13 is located to be directly facing and
23 pointing at the aligned open ends 248 and 242 of the shield 240
24 and cavity 240, such that the sound reproduced by the speaker
25 13 is concentrated and guided by the conically tapered open
26 ends 248 and 242 into the second cavity 250.

27

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1 A passage 241 is formed at the interface between the
2 confronting walls 222 and 232 of the two box parts 220 and 230,
3 which extends from rear ends of the first cavity 240 and shield
4 244 to the outside at the first end 212 of the box 210. The
5 passage 241 accommodates and allows the section of the cable 16
6 of the hands-free earphone 12 connecting between the speaker 13
7 and the signal plug 15 to extend out of the box 210, such that
8 the signal plug 15 stays outside the box 210.

9

10 The second cavity 250 extends in a spiral manner or shape of at
11 least half a turn and up to two turns, having outer and inner
12 open ends 252 and 254. The outer end 252 is integrally formed
13 with the open end 242 of the first cavity 240. The first cavity
14 240 is oriented at an acute angle of about 45° relative to the
15 second cavity 250 such that their open ends 242 and 248 are co-
16 axially aligned with each other. This arrangement ensures that
17 the sound of the speaker 13 from the first cavity 240 can enter
18 straight, without turning, into the second cavity 250, whereby
19 loss of sound is minimised.

20

21 The second cavity 250 provides a smoothly curved, spiral sound
22 passage for delivering the sound received from the first cavity
23 240. The inner end 254 of the second cavity 250 turns through
24 an angle of 90° to point downwards off the plane of the spiral
25 shape.

26

27 The third cavity 260 has an oblong shape that extends laterally
28 across the box 210 and corresponds to that of the microphone 14

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1 of the hands-free earphone 12 for housing the entire microphone
2 14. A metal (copper or aluminium) shield 264 of a matching
3 shape is located within the cavity 260 to cover, in ultimate
4 surface contact with, substantially the entire inner surface of
5 the cavity 260. The shield 264 is formed by a pair of identical
6 upper and lower shells 266 closing with each other to surround
7 the microphone 14, and serves to confine electromagnetic
8 radiation of the microphone 14 within the cavity 260 and thus
9 avoid or minimise its leakage out of the cavity 260.

10

11 Although this is not shown in the drawings, another passage is
12 formed at the interface between the confronting walls 222 and
13 232 of the two box parts 220 and 230, which extends between the
14 first and the third cavities 240 and 260 and accommodates the
15 section of the cable 16 connecting between the speaker 13 and
16 microphone 14.

17

18 The hands-free kit 200 further includes a flexible acoustic
19 tube 270/280 that is formed by a relatively long rubber tube
20 270 and a relative short soft plastic pipe 280 connected
21 lengthwise together. The rubber tube 270 has a crooked first
22 end 272 placed inside the lower part 230 of the box 210, which
23 is stretched over to connect with the inner end 254 of the
24 second cavity 250, for communicating with the cavity 250. An
25 integral hook or bracket 268 extends from below the third
26 cavity 260 and holds the tube 270 in place. The tube 270
27 extends out from the second end 214 of the box 210 and then

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1 terminates as a straight second end 274 formed with an annular
2 integral flange 276.

3

4 The pipe 280 is crooked, having a first end 282 coupled
5 straight with the second end 274 of the rubber tube 270 by
6 means of a rigid locking collar 278, and including a second end
7 in the form of an earplug 284. The collar 278 is slid on and
8 locks the pipe end 282 tightly around the tube end 274 at a
9 position stopped by the flange 276.

10

11 The earplug 284 has a central tubular plug 286 and a generally
12 flat cylindrical outer flange 288 extending concentrically
13 around the plug 286. The flange 288 is spaced apart from the
14 plug 286 and is integrally connected to the rear end of the
15 plug 286 by a circular disc-like web 287. The flange 288 and
16 the web 287 together resemble a cap, with the plug 286
17 protruding slightly out of the cap or beyond the flange 288.
18 When the earplug 284 is inserted into the ear of a user, the
19 plug 286 extends into the hole of the ear for sound delivery,
20 while the flange 288 holds onto the inner surface of the ear by
21 friction and thus locates the overall earplug 284 in place.

22

23 The top part 220 of the box 210 is hollow around the regions
24 forming the upper halves of the cavities 240 to 260, and its
25 outer (upper) side 217 is open into which the hollow interior
26 is accessible. The interior is useful to store the acoustic
27 tube 270/280 over the majority of its exposed length and the
28 signal plug 15 with cable 16 running therefrom, when the hands-

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1 free kit 200 is not in use. Appropriate top cut-outs may be
2 formed in the side walls of the box part 220 to facilitate
3 entrance of the acoustic tube 270/280 and the signal plug cable
4 16 into the storage space. The open side 217 is to be closed by
5 a flap 218 extending from a longer side of the box 210 to the
6 opposite side where suitable Velcro (trade mark) connectors 219
7 are provided.

8

9 The box 210 measures approximately 8.5cm by 5.6cm, and the
10 exposed length of the acoustic tube 270/280 is preferably in
11 the range from 16.5cm to 28cm.

12

13 In use, the hands-free kit 200 is hanged on the chest of a user
14 by means of the clip 216, with the signal plug 15 connected to
15 a mobile phone and the earplug 284 inserted into either the
16 left or the right ear of the user. The acoustic tube 270/280,
17 which is joined to the second cavity 250, acts as an acoustic
18 passage for delivering the sound of the speaker 13 received
19 from the first cavity 240 via the second cavity 250. The sound
20 travels on to reach the user's ear via the earplug 284.

21

22 The acoustic tube 270/280 serves to separate the speaker 13
23 physically apart from the user's ear, and hence the brain, for
24 a distance that is believed to be sufficiently long to isolate
25 or at least substantially minimise the undesirable effect of
26 the electromagnetic radiation of a mobile phone in use as
27 transmitted or emitted by the speaker 13. The tube 270/280 does
28 not contain any metallic or electrically conductive material

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1 that transmits electromagnetic radiation. The tube 270/280 is
2 preferably made of (silicone) rubber and/or plastic material or
3 any other suitable non-metallic material. Certain material
4 known to suppress or absorb electromagnetic radiation may also
5 be used, as either the base material or an additive.

6

7 As shown in Figure 8, the hands-free kit 200 may incorporate a
8 pair of the acoustic tubes 270/280, in which case the ends 272
9 of both tubes 270 are connected to the inner end 254 of the
10 second cavity 250 for simultaneous communication with the
11 cavity 250. The pair of earplugs 284 can be used in both the
12 left and right ears of a user.

13

14 As shown in Figure 9, the earplug 284 may incorporate a semi-
15 circular bracket 285 for hooking onto the user's ear.

16

17 It is intended that the hands-free kit 200 may be supplied to
18 the market without the hands-free earphone 12, such that
19 customers may use their own hands-free earphones of the same or
20 similar construction having compatible dimensions. For this
21 purpose, the two parts 220 and 230 of the box 210 should not be
22 welded or glued together in the first place but instead should
23 be openable to allow insertion of a suitable hands-free
24 earphone.

25

26 The invention has been given by way of example only, and
27 various other modifications of and/or alterations to the
28 described embodiments may be made by persons skilled in the art

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- 1 without departing from the scope of the invention as specified
- 2 in the appended claims.

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